الجمهورية الجزائرية الديمقراطية الشعبية
People's Democratic and Republic of Algeria

Ministry of Higher Education and Scientific Research

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NSCS
المدرسة الوطنية العليا في الأمن السيبراني
NATIONAL SCHOOL OF CYBERSECURITY

وزارة التعليم العالي والبحث العلمي

المدرسة الوطنية العليا في الأمن السيبراني

Tutorials 3: Queues and Stacks (1/2)

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Exercise 1:
Let Q be a queue. Write an algorithm to reverse the queue. Use only queue operations (i.e., Enqueue, Dequeue).

Exercise 2:
Given two sorted queues, Q1 and Q2. Merge the two queues into a single sorted queue Q1 (in place) by inserting elements from Q2 into Q1 while maintaining the order.

Exercise 3:
A priority queue is a queue in which the dequeue operation retrieves the most prioritized element. Each element in the queue has an associated priority, and when elements are dequeued, the one with the highest priority is removed first.

Exercise 4:
Given a queue containing integers. Write a function that returns a queue containing only the even numbers extracted from the original queue.

Exercise 5:
To simulate a one-way road intersection, we use 3 queues: f1, f2, and f3, which represent the cars arriving on roads R1 and R2, and the cars departing on road R3.
The road R2 has a STOP sign. The cars in queue f2 can only move forward if there are no cars on road R1, meaning queue f1 is empty. Write an algorithm to simulate the departure of cars onto road R3, modeled by queue f3, so that:

- In queue f1, the presence of a car is represented by the number 1 and the absence of a car by 0.
- In queue f2, the presence of a car is represented by the number 2 and the absence of a car by 0.
- Test the algorithm with f1: head <- [0, 1, 1, 0, 1] <- tail.
- Test the algorithm with f2: head <- [0, 2, 2, 2, 0, 2, 0] <- tail.
- The expected result: f3 head <- [0, 1, 1, 2, 1, 2, 2, 0, 2, 0] <- tail.

What should the algorithm do if both the front of the queues are 0?
What should the algorithm do if the front of f1 is 1 and the front of f2 is 2?
What should the algorithm do if the front of f1 is 1 and the front of f2 is 0?
What should the algorithm do if the front of f1 is 0 and the front of f2 is 2?
What should the algorithm do if one of the queues is empty?

Write an algorithm that models this intersection. You will use a function def intersection (f1, f2) that takes two queues, f1 and f2, as parameters and returns a queue f3 containing the cars on road